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A New Curriculum for Ethology & Student Skills in the Netherlands

Bram J. Jansen Maurits J. Dijkstra Alex Bloem

IN the Netherlands, a new National Curriculum for Secondary Education in Biology was implemented in 1993/1994. Ethology (Behavioral Biology) was a new part of it. Another innovation concerns the introduction, on a compulsory basis, of such student skills as research, information processing, formulating opinions on social/biological issues, and orientation about biological professions.

Our department has been involved in the development and implementation of these two innovations. Our work has been structured by the "action research" methodology in which the teachers' practice plays a dominant role. (Contrary to the American situation, action research is rather unknown in the Netherlands.) Furthermore, we are involved in a "bottom-up" strategy for the implementation of the innovations.

In this article we report about the new biology curriculum in the Netherlands; the ethology content in the curriculum; different didactic aspects of our lessons on ethology education; and the student skills that are part of the new curriculum and their place in our lessons. In a second article, to be published in the October issue of *ABT*, we will discuss: our action research activities for the new curriculum; the roles played by biology teachers; the role of our teacher education center; and the bottom-up implementation strategy.

A New Type of Biology Education

Biology officially got its place in the secondary education national curriculum in 1976. Biology was already on the school weekly timetable, but in 1976 it became one of the subjects in the national final examinations. However, the national curriculum on biology that was the basis for these examinations soon came under heavy pressure because of its one-sidedness (plant and animal systematics, anatomy and physiology, classical genetics). Modern branches of biology,

such as ecology, ethology, the theory of evolution, applied biology (e.g. agriculture, environmental science, health care), and various kinds of student skills (e.g. research, information processing, value clarification, etc.) were not included in the program. All these items, many of which were popular with both teachers and students, came in second place. This meant that teachers could hardly spend more than a few lessons on them, if any. In 1982, the Ministry of Education and Sciences installed the Biology Examination Workgroup (in Dutch in short: WEB). The main task of this group was to develop new directions for a modernized program for examinations in biology. In 1985 the group presented a set of General Objectives for biology education that is quite different from the old one.

General Objectives of the New Biology Curriculum in the Netherlands

The general objectives of the new biology curriculum are threefold. They refer to:

1. The science of biology as a subject
2. The impact of biology on the personal and social development of the students
3. The vocational education and professional future of the students.

Table 1 gives the full text of the General Objectives.

For Topic 1 (the subject of biology) a new structure has been worked out. There are four leading concepts: biological structures, life-cycle, metabolism, and stability and change.

All four topics have been subdivided into chapters relating to the ecosystem level, the organism level, and the cell level.

Topics 2 and 3 have been given equal space. These two categories have been worked out in a few different ways. First, a set of four General Skills to be attained in biology education has been formulated (see Table 5). Secondly, so-called "context areas" have been chosen: relevant topics in modern society that have an important impact on the life of individual citizens and society as a whole. For the VWO (Voorbereidend Wetenschappelyk Onderwys) level (six years, leading to university admission), four context areas have been formulated: Human Health, Nature and Environment, Agriculture/Livestock, and Biotechnology.

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Table 1. General objectives for biology education.

1. Concerning the subject biology:
 - 1.1. biological relations, for instance between structure and function
 - 1.2. interdependence within the biosphere, and the role of mankind
 - 1.3. the way biological knowledge can be acquired; the meaning of biological data for the use of bacteria, fungi, plants, animals.
2. Concerning personal development and social education:
 - 2.1. consciousness about 'life', respect and responsibility for living beings and the biosphere
 - 2.2. application of biological knowledge in daily life (e.g. consumerism, health, sexuality, environment)
 - 2.3. recognition of biological aspects in social settings, their positive and negative elements; formulating a considered personal perception for, among other things, decisions for personal behavior
 - 2.4. social skills, such as having regard for other people, seeing other points of view, communication.
3. Concerning further education and vocational situations:
 - 3.1. acquaintance with all aspects of biology as a field of study, important for choices for further education
 - 3.2. acquaintance with biology as applied in vocational education and vocational settings.

For the HAVO (Hoger Algemeen Vormend Onerwys) level (five years leading to admission to polytechnics), there are three context areas: Human Health, Man and Environment, and Food (production, supply, consumption).

The idea here is that all biology subject matter—in textbooks and in lessons—is treated as much as possible in the light of one of these context areas.

Thirdly, half of the examination marks for biology will be made up of school test results: Different sorts of practical work will form a large part of these tests (in Dutch: "*het handelingsdeel*": "the action part"). The other half will be made up of the national examination, to be given every year in May. Teachers assess the results of all school tests.

Lessons on Ethology & Student Skills: Schemes & Main Objectives

The way we elaborated the General Objectives and General Skills of the new biology examination program can be seen in the two series of lessons that have been developed by our team of teachers. One is called "Ethology and Traffic" (15 lessons) and is built around inventory and experimental research in real traffic situations, including traffic behavior of the students themselves. The other is called "Communication of Man (and Animals)" (12 lessons) and consists of many tasks—varying from very small to much larger—on research, opinion formulation and value clarification about human communicative behavior (inside and outside the school). Schemes of both series and the underlying objectives are as follows:

Table 2. Scheme of lessons on 'Traffic'.

Part	Number of Lessons	Contents of the Lessons
I	2	<i>Introduction on the Lessons</i> The teacher introduces objectives and structure of the lessons, the theme (= ethology and student skills), roles of teacher (= facilitating), roles of students (= self-reliant work), place of theory (= to be inductively incorporated in student reports) and the assessment-strategy (= a written test on animal behavior + research reports); small groups of students make working plans for field research.
II	4	<i>Field Research</i> Small groups of students elaborate a research design; execute research in the city; prepare reports on their findings (included relevant theory on ethology).
III	3	<i>Theory</i> Students study and digest theory on ethology to be incorporated in their reports (materials: textbooks and videotapes).
IV	1	<i>Value Clarification</i> Small group discussions and value clarification re: student behavior in traffic.
V	6	<i>Presentation of Student Reports</i> Students present their research findings to the other students; the teachers introduce some more theory on ethology if necessary.
VI	2	<i>Evaluation</i> Students and teacher evaluate products (research outcomes) and process (self-reliant working) of the lessons; students perform an assessment test on animal behavior.

(Note: One lesson lasts 50 minutes; most students have three or four lessons in biology a week; classes consist of up to 30 students.)

In the following sections of this article we will give details about four aspects:

- Ethological theory and the emphasis on human behavior
- Research tasks
- Information processing and opinion formulating
- Visits to vocational settings.

We will also give quotations from the students about their experiences with these lessons, but first the schemes of the two series of lessons.

The scheme of the lessons on "Ethology and Traffic"—in short "Traffic"—is given in Table 2. These lessons have been developed by Jan de Vries, a biology teacher in a school for secondary education in Zwolle.

These lessons show:

- Students doing research in real traffic situations. This is the main part of the series: one of the four themes is to be performed in groups of four to five students; with each group working on one of the four themes.
- The teacher's role is mainly one of supervision: stimulating, talking with the students about their questions/hesitations/problems/ideas/etc., deciding about the assessment strategy, and leading the classroom discussions.
- Theory is to be brought in by the students from ready-made literature and videotapes, and by the teacher, who relates it to the research themes of the groups of students.

The other series, called "Communication in Man (and Animals)"—in short "Communication"—has been developed by Jaap van Egmond, a biology teacher in a school for secondary education in Drachten, with the help of a student in biology. It has been elaborated by Bart Dertien, a biology teacher in another school in Drachten, also with the help of a student. The complete scheme is shown in Table 3.

These lessons are based on the following points:

- Practical work plays the main role: many small-scale tasks for students.
- All three practical skills are elaborated: research, information processing/opinion formulating, and visiting vocational settings.
- Ethological theory is structured by the teacher, and presented both by students and by the teacher.

The New Curriculum & Ethology

In the Netherlands, just as in Great Britain and the United States, ethology has been an evergrowing science since World War II. Especially in Leiden and Groningen, important research has been done by Tinbergen, Baerends, Kruyt and van Iersel, among others. Since 1976, ethology has had a minor, optional place in the VWO and HAVO biology curricula, when it acquired official status in the new national curriculum.

What subjects are part of this examination program?

The main subjects are:

- Organization of behavior
- Causation of behavior (by internal factors and external stimuli)
- Genetic aspects of behavior
- Learning processes; influence of genes and environment
- Social behavior and communication
- Functions of behavior; ultimate causation.

The complete list of all ethological concepts in the examination program is given in Table 4.

It is our job to place all the terms and concepts—and

Table 3. Scheme of lessons on 'Communication'.

Part nr.	Number of Lessons	Contents of the Lessons
I	2	<i>Introduction</i> The teacher introduces objectives and structure of the lessons, the theme (= ethology + student skills), roles of teacher (= teaching, facilitating), roles of students (self-reliant work), place of theory (= to be deductively and inductively incorporated), and the assessment strategy (= a written test on animal behavior + reports on the bigger task); students work on introductory tasks: observing and registering (animal) behavior (life and on video).
II	3	<i>Group Tasks</i> Students perform in small groups one practical task out of a series of 15: they execute the task and prepare a poster-presentation.
III	1-2	<i>Theory</i> Class discussions of the poster presentations; the teacher presents some additional theory on ethology.
IV	4	<i>Application Tasks</i> Students elaborate in small groups one larger task out of three: a research project, the study of literature, a visit to a vocational setting; the subject is: (the ethological study of) human behavior or animal behavior in society.
V	1-2	<i>Evaluation</i> Students perform an assessment test on animal behavior; students and teacher evaluate products (outcomes of the larger tasks) and process (self-reliant work) of the lessons.

other ones if we consider them useful—into a teacher-ready curriculum for ethology. Professional ethologists have been consulted and a special booklet about ethology in secondary education will be delivered.

Table 4. Ethological concepts in the VWO examination program (content according to the program, structure according to ethology textbooks).

1. Causation of behavior:
external stimuli, sensory systems, internal state, muscles, glands, pigment cells, behavior patterns, ethogram.
2. Regulation:
regulating organs, signal stimuli, summation of stimuli, supernormal stimuli, internal state, motivation, behavioral patterns, behavioral systems, stereotypical systems (case: stickleback).
3. Learning:
associative learning, search patterns, learning capabilities, learning without reward, tradition.
4. Social behavior:
social behavior, interactions, group formation, communication (case: social behavior of chimpanzees).

Role of Ethological Theory in the Lessons

In both series of lessons ethological theory is incorporated in two different ways: inductively and deductively. In the lessons on Traffic, the students have to determine what theory may be relevant for their own research topic by using books and videotapes (induction). They give their reports on this part of their work to the other students (deduction). In both phases of this series the teacher only helps in choosing literature (the inductive work), and teaches about the connection between different terms and concepts (deduction).

In the series on Communication, theory has a more structured place. The 15 different tasks of Part II (see Table 3) are built on one or more ethological concepts, and the students are asked to report on these in their poster presentations (induction). In Part III the teacher explains all the concepts related to the tasks that have been chosen by the students by means of one or two lessons of classroom discussions. Concepts that are not reported by students have to be taught by the teacher (deduction). In Part IV (research, etc.) understanding of the theory has to be incorporated as extensively as possible in the final reports of the students (deduction).

In both series of lessons, the students have to learn a text on ethological theory for a theoretical test. This

may seem to be difficult for students, but our experience up until now has shown us that doing research is a much more meaningful preparation for a theoretical test than are the theory lessons by the teacher.

The Emphasis on Human Behavior

In conventional ethology education in the Netherlands, all concepts are related to classical research findings (by Tinbergen, Baerends, Lorenz, etc.); they are really—in simplified form—copies from university textbooks. The same is true for most videotapes that are made for educational purposes. Students usually do like the tapes, but most of them do not become really interested in animal behavior, and any attempt to make a link with human behavior is usually doomed to end as merely a futile exercise. For these reasons we have chosen a radical new point of departure: We place human behavior at the center of the lessons. In this way we hope (see Table 1) that the students learn about ethology and about their own behavior (habits, values, skills, etc.). But there may still be a danger: It may be that ethological theory cannot sufficiently be taught! For no one has tried to write (a chapter in) a schoolbook on ethology based on human behavior. However, from what we have seen so far, we have at least one reason to think we have

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gambled well: The written assessment tests the students had to fulfill at the end of the lessons—and in which all questions were linked to animal behavior—were all completed successfully.

Which Student Skills Are To Be Trained, & in Which Contexts?

Students must demonstrate at least three kinds of practical skills (see Table 5) that are tested in the

Table 5. General student skills in biology education.

1. Application of insights in biological relations (among cell-, organ-, organism- and ecosystem-levels) in problem solving
2. Execution of a biological research project
3. Application of biological knowledge in vocational settings
4. Gathering biological information from different sources; verbal and written communication
5. Use of biological knowledge in daily life: value clarification, formulating opinions, making decisions
6. Use of models in biology

school examination:

1. Conducting research: Students should know which skills are needed for good research and how it should be done. Doing their own research is seen as one important way of developing these skills.
2. Information processing and opinion formulating: In modern society information plays a very important role. Students should learn to find their way in the written media, to use information in an adequate manner, and to state their own opinions.
3. Visiting vocational settings with biological components: Knowledge of biology is part of the professional knowledge of various scientific and nonscientific vocations. Making the students acquainted with the practice of such professions is a new facet of secondary education in the Netherlands.

For both types of schools, VWO and HAVO, some specific context areas have been chosen to relate biological subject matter to society and to the personal interests of the students (see above). The roles these context areas can or should play in biological education may vary.

First, a large part of the specific biological knowledge of the new VWO and HAVO examination programs must be related to one or more of the four contexts of each program; e.g. all subject matter about genetics must be taught and learned in relation to the contexts Agriculture/Livestock, Biotechnology, and Human Health; and the subject matter about ecosystems must be related to the contexts Nature & Environment, and Agriculture/Livestock. It is foreseen

that a number of the questions on the national biology exam will be formulated around context-related information.

Second, some student skills can be trained in real context situations, e.g. research may be done outside school, in social settings, and orientation about vocational settings with biological aspects (hospital, horse riding schools, etc.) will usually be done in those institutions.

Third, information processing can be connected to a certain extent to material on social phenomena with biological aspects. In fact most parts of the “action part” of the school tests can only be executed in real context situations.

Fourth, teachers are free to make their education “context related.” They may place the personal and social meaning of education in the forefront; e.g. they can work with their students on environmental problems, personal health care, etc. In that case the written national examination in May will be regarded—by the teacher and possibly by the students—as a disturbing (but inevitable) occurrence sometime in the last year of schooling.

Research Tasks in the Lessons

We see research into behavior—or into any biological subject whatsoever—as a highly complex but intriguing process of wondering, asking questions, stating hypotheses, problem solving, fact finding, etc. Every human being is involved in it simply by being alive. We see research in a very broad sense as a natural capacity of every living human being. “Research” is therefore a collective noun for lots of activities.

The image that older textbooks (on science, the philosophy of science, the sociology of science) give of “scientific research” (e.g. ethological research) is a very artificial one. This so-called “standard image” of scientific research appears to be no more than a rhetorical construct. There is no research that really follows the path of wondering, formulating research questions and hypotheses, developing a work plan with methods and materials, executing the investigations, and formulating conclusions. The real pathway of doing research is full of moments of guesswork and hesitation. It is also very creative: Lots of new terms and concepts are formulated as ideas that afterwards appear to make sense (or not). Modern literature on the philosophy and sociology of science has examined this process in more detail. For these reasons we distinguish between two different types of research tasks (on ethological items) for students:

1. Small-scale tasks to be seen as very limited aspects or parts of the iterative process of investigating. These are, among others: simple observing, stating questions, developing observational

instruments, questioning “normal happenings” in school, distinguishing between personal and objective reactions to stimuli, developing experimental situations, executing them, etc. In Table 6 examples can be seen of such small-scale tasks that are part of both series of lessons.

Table 6. Fifteen small tasks in Part II of lessons on ‘Communication’ (titles and, in brackets, a short description of the character of the tasks are given).

N.B.: Each task consists of:

- a. description of the work to be done
 - b. possible extensions of the task
 - c. objectives
 - d. a set of ethological terms and definitions to be used in the poster
 - e. questions for value clarification
 - f. necessary materials (information, drawings, texts, schemes, etc.)
1. ‘Observing a teacher in his/her classroom’
(practical work in the school; ethogram)
 2. ‘Observing a group of students’
(practical work in the school; ethogram)
 3. ‘Your favorite schoolbook’
(types of written communication)
 4. ‘Behavior and environmental issues in school’
(study of stimuli and reactions in school)
 5. ‘Moods’
(role playing, nonverbal behavior)
 6. ‘Advertising’
(stimuli, sign stimuli, releasers, printed matter)
 7. ‘Baby faces’
(the ethological item; printed matter)
 8. ‘Talking animals and talking man’
(different ways of communicating; texts and experience)
 9. ‘Innate and/or acquired behavior’
(applied to students’ capacities; in school, at home)
 10. ‘Hints’
(TV—play; nonverbal communication)
 11. ‘Signaling a drawing’
(practical task; without and with feedback)
 12. ‘Selection of stimuli and social behavior’
(subjective and objective interpretation of peoples’ outlook; printed matter)
 13. ‘Ethogram of a student’
(analysis of prepared text)
 14. ‘Communication in print’
(analysis and selection of different types of information)
 15. ‘Learning of animals and man’
(printed, ethological matter on learning)

2. Larger tasks in which the students are asked to perform their own research on some ethological topic (in our case concerning human traffic behavior or communication), and to deliver a report on the results and the research process. In both series of lessons this task occupies a major place. Students are asked to choose a personally relevant question from their daily experiences, life at home, social activities, etc. Table 7 lists four such research questions in each series of lessons.

Table 7. Research questions/topics in the lessons on ‘Traffic’ and ‘Communication’.

In Part II of the lessons on ‘Traffic,’ four different research questions have been formulated:

(N.B.: All questions have been elaborated into practical-observational and/or experimental-work in the city of Zwolle.)

- * What role do ‘sign stimuli’ play in traffic?
- * What kind of ‘conflict situations’ exist in real traffic?
- * What patterns of social behavior exist in traffic, e.g. among cyclists?
- * Which differences exist between different roles in traffic? (man/woman, young/elderly, drivers/walkers, etc.)

In Part IV of the lessons on ‘Communication’ six different topics have been chosen:

(N.B.: All topics have been elaborated into research questions and practical research projects in the city of Drachten.)

- * Behavior of spectators at sports activities
- * Behavior of cats and dogs living in homes and animal shelters
- * Aggressive behavior in sports
- * Stimuli and food-buying behavior
- * Social behavior and cats
- * Behavior of passengers in trains

Information Processing & Formulating Opinions in the Lessons

In both series these types of student skills play an important role. What can be seen as information

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processing in these lessons? We distinguish the following activities:

- Studying literature (ethological)
- Studying texts and pictures of videotapes (ethological)
- Preparing written reports on performed research ("Traffic" and "Communication")
- Preparing written reports on literature studied ("Communication")
- Preparing written reports on visits to vocational settings ("Communication")
- Preparing posters about the performed tasks ("Communication")
- Making summaries and conclusions from the student reports/posters on the research tasks ("Traffic") and the small tasks ("Communication").

Formulating opinions (or stated more precisely, any form of examining, clarifying or stating of the students' own values, habits and opinions) takes place on several occasions. In the lessons on "Traffic" the students' opinions play a role in two topics: They are asked what they think about their own traffic behavior and what their opinions are about peoples traffic behavior. For example, they are asked what they think of ignoring rules and signals in traffic, what are the differences in their behavior when traveling home after school by bike (very popular in The Netherlands!) with or without a group of students, etc. The teacher leads the class discussions about this. In this way the subject of the lessons is linked to their own lives.

Moreover the students are asked to think about the planning of the lessons, the desirable roles of the teacher, the evaluation of the results, etc. In this way the teacher challenges them to think independently about education in the school system.

In the "Communication" lessons, students are asked for their opinions, values, etc. in almost all small tasks (in Part II); e.g. after making an ethogram of other students in the school (small task #2), the students are asked to think about and discuss their own school behavior in comparable situations, and likewise in the larger tasks (of Part IV). The students give their own experiences and try to add their own opinions about the facts they find. It is up to the teacher to decide how much emphasis should be given to discussing all the opinions, values, etc. the students have discovered.

Visiting Vocational Settings in Lessons

In the "Communication" lessons, preparing, executing and reporting on a visit to a professional biologist, physician, educator, etc. is one of the possibilities for the larger tasks in block 4. Professionals, institutions, or social activities visited in 1991 were:

- A maternity ward
- A kindergarten class
- A dog obedience course
- A horse riding school
- A dog and cat shelter
- An ergotherapist
- A hospital for babies.

The students pay attention to the daily work of the professional, especially to the behavioral aspects of the work that is done, and in their reports they write about their experiences, and about the ethological theory that is relevant to the situations they meet, as well as to their own opinions on the data they collect.

Conclusion

For most biology teachers in secondary education in the Netherlands things are changing a great deal, as may be apparent from this article. We would like to hear about biology education in general in America and more specifically the subject matter of ethology and skill training. If you are interested in more details about our New Curriculum on Biology (or ethology in particular), or about our innovative curriculum project, please write to us at: Bram J. Jansen, University of Groningen, Biological Sciences, Department of Education, Kerklaan 30, 9751 NN Haren, The Netherlands.

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